CLAIMS

I claim:

1. A concentric pipe joint restraint, said restraint resisting axial movement of a spigot pipe relative to a socket pipe within which a portion of said spigot pipe has been inserted, said spigot pipe and said socket pipe defining an annulus, said restraint comprising:

a spigot wedge ring comprising one or more spigot gripping protrusions;

socket wedge ring comprising one or more socket gripping protrusions; and

a wedge housing positioning said spigot wedge ring relative to said socket wedge ring with which it is in effective contact in said annulus such that said spigot gripping protrusions grip said spigot pipe and said socket gripping protrusions grip said socket pipe.

2. The restraint of claim 1 wherein:

said spigot wedge ring further comprises a frusto-conical surface; and

said socket wedge ring further comprises an opposed frusto-conical surface in effective contact with said frusto-conical surface.

3. The restraint of claim 2 wherein the gripping protrusions are biased to prevent axial separation of the pipes.

4. The restraint of claim 3 wherein the frusto-conical surfaces are biased to prevent axial separation of the pipes.

5. The restraint of claim 4 further comprising an actuator driving said gripping protrusions into said pipes by imparting axial movement of said wedge rings relative to one

another, said axial movement imparting sliding axio-radial movement of said frusto-conical surfaces relative to one another.

6. The restraint of claim 2 wherein the gripping protrusions are biased to prevent axial compression of the pipes.

7. The restraint of claim 6 wherein the frusto-conical surfaces are biased to prevent axial compression of the pipes.

8. The restraint of claim 7 further comprising an actuator driving said gripping protrusions into said pipes by imparting axial movement of said wedge rings relative to one another, said axial movement imparting sliding axio-radial movement of said frusto-conical surfaces relative to one another.

9. The restraint of claim 2 wherein the frusto-conical surfaces are biased to prevent axial separation of the pipes.

10. The restraint of claim 9 further comprising an actuator driving said gripping protrusions into said pipes by imparting axial movement of said wedge rings relative to one another, said axial movement imparting sliding axio-radial movement of said frusto-conical surfaces relative to one another.

11. The restraint of claim 2 wherein the frusto-conical surfaces are biased to prevent axial compression of the pipes.

12. The restraint of claim 11 further comprising an actuator driving said gripping protrusions into said pipes by imparting axial movement of said wedge rings relative to one

another, said axial movement imparting sliding axio-radial movement of said frusto-conical surfaces relative to one another.

13. The restraint of claim 2 wherein at least one wedge ring further comprises circumferential end portions.

14. A concentric pipe joint restraint, said restraint resisting axial movement of a spigot pipe relative to a socket pipe within which a portion of said spigot pipe has been inserted, said spigot pipe and said socket pipe defining an annulus, said restraint comprising:

a spigot wedge ring module comprising a spigot wedge ring housing positioning a spigot wedge ring comprising spigot gripping protrusions in said annulus; and

a socket wedge ring module comprising a socket wedge ring housing positioning a socket wedge ring comprising socket gripping protrusions in said annulus.

15. The restraint of claim 14 wherein at least one of said wedge ring modules further comprises a wedge ring housing comprising a curved axial end portion to facilitate sliding radial movement between the modules when said modules are in contact with one another and said spigot pipe and said socket pipe are moved out of axial alignment.

16. The restraint of claim 14 wherein said spigot wedge ring further comprises a frusto-conical surface in effective contact with an opposed frusto-conical surface in said spigot wedge ring housing.

17. The restraint of claim 16 wherein said spigot gripping protrusions are biased to prevent axial separation of the pipes.

18. The restraint of claim 17 wherein said frusto-conical surfaces are biased to prevent axial separation of the pipes.

19. The restraint of claim 18 further comprising an actuator driving said spigot gripping protrusions into said spigot pipe by imparting axial movement of said spigot wedge ring relative to said spigot wedge ring housing, said axial movement imparting sliding axio-radial movement of said frusto-conical surfaces relative to one another.

20. The restraint of claim 16 wherein said spigot gripping protrusions are biased to prevent axial compression of the pipes.

21. The restraint of claim 20 wherein said frusto-conical surfaces are biased to prevent axial compression of the pipes.

22. The restraint of claim 21 further comprising an actuator driving said spigot gripping protrusions into said spigot pipe by imparting axial movement of said spigot wedge ring relative to said spigot wedge ring housing, said axial movement imparting sliding axio-radial movement of said frusto-conical surfaces relative to one another.

23. The restraint of claim 22 wherein said spigot wedge ring housing further comprises a socket stop, said socket stop comprising a radially outwardly extending ledge engaging the terminal end portion of said socket pipe.

24. The restraint of claim 16 wherein the frusto-conical surfaces are biased to prevent axial separation of the pipes.

25. The restraint of claim 24 further comprising an actuator driving said spigot gripping protrusions into said spigot pipe by imparting axial movement of said spigot wedge ring

relative to said spigot wedge ring housing, said axial movement imparting sliding axio-radial movement of said frusto-conical surfaces relative to one another.

26. The restraint of claim 16 wherein the frusto-conical surfaces are biased to prevent axial compression of the pipes.

27. The restraint of claim 26 further comprising an actuator driving said spigot gripping protrusions into said spigot pipe by imparting axial movement of said spigot wedge ring relative to said spigot wedge ring housing, said axial movement imparting sliding axio-radial movement of said frusto-conical surfaces relative to one another.

28. The restraint of claim 27 wherein said spigot wedge ring housing further comprises a socket stop, said socket stop comprising a radially outwardly extending ledge engaging the terminal end portion of said socket pipe.

29. The restraint of claim 14 wherein said socket wedge ring further comprises a frusto-conical surface in effective contact with an opposed frusto-conical surface in said socket wedge ring housing.

30. The restraint of claim 29 wherein said socket gripping protrusions are biased to prevent axial separation of the pipes.

31. The restraint of claim 30 wherein said frusto-conical surfaces are biased to prevent axial separation of the pipes.

32. The restraint of claim 31 further comprising an actuator driving said socket gripping protrusions into said socket pipe by imparting axial movement of said socket wedge ring

relative to said socket wedge ring housing, said axial movement imparting sliding axio-radial movement of said frusto-conical surfaces relative to one another.

33. The restraint of claim 29 wherein said socket gripping protrusions are biased to prevent axial compression of the pipes.

34. The restraint of claim 33 wherein said frusto-conical surfaces are biased to prevent axial compression of the pipes.

35. The restraint of claim 34 further comprising an actuator driving said socket gripping protrusions into said socket pipe by imparting axial movement of said socket wedge ring relative to said socket wedge ring housing, said axial movement imparting sliding axio-radial movement of said frusto-conical surfaces relative to one another.

36. The restraint of claim 35 wherein said socket wedge ring housing further comprises a spigot stop, said spigot stop comprising a radially inwardly extending ledge engaging the terminal end portion of said spigot pipe.

37. The restraint of claim 29 wherein the frusto-conical surfaces are biased to prevent axial separation of the pipes.

38. The restraint of claim 37 further comprising an actuator driving said socket gripping protrusions into said socket pipe by imparting axial movement of said socket wedge ring relative to said socket wedge ring housing, said axial movement imparting sliding axio-radial movement of said frusto-conical surfaces relative to one another.

39. The restraint of claim 29 wherein the frusto-conical surfaces are biased to prevent axial compression of the pipes.

40. The restraint of claim 39 further comprising an actuator driving said socket gripping protrusions into said socket pipe by imparting axial movement of said socket wedge ring relative to said socket wedge ring housing, said axial movement imparting sliding axio-radial movement of said frusto-conical surfaces relative to one another.

41. The restraint of claim 40 wherein said socket wedge ring housing further comprises a spigot stop, said spigot stop comprising a radially inwardly extending ledge engaging the terminal end portion of said spigot pipe.

42. A concentric pipe joint restraint, said restraint resisting axial movement of a spigot pipe relative to a socket pipe within which a portion of said spigot pipe has been inserted, said spigot pipe and said socket pipe defining an annulus, said restraint comprising:

a spigot wedge ring comprising one or more spigot gripping protrusions;

a socket wedge ring comprising one or more socket gripping protrusions; and

a wedge housing positioning said wedge rings in said annulus such that said spigot gripping protrusions grip said spigot pipe and said socket gripping protrusions grip said socket pipe.

43. The restraint of claim 42 wherein said wedge housing further comprises a socket stop, said socket stop comprising an radially outwardly extending ledge engaging the terminal end portion of said socket pipe.

44. The restraint of claim 42 wherein said wedge housing further comprises a spigot stop, said spigot stop comprising a radially inwardly extending ledge engaging the terminal end portion of said spigot pipe.

45. The restraint of claim 42 wherein said spigot wedge ring further comprises a frusto-conical surface in effective contact with an opposed frusto-conical surface in said wedge ring housing.

46. The restraint of claim 45 wherein said spigot gripping protrusions are biased to prevent axial separation of the pipes.

47. The restraint of claim 46 wherein said frusto-conical surfaces are biased to prevent axial separation of the pipes.

48. The restraint of claim 47 further comprising an actuator driving said spigot gripping protrusions into said spigot pipe by imparting axial movement of said spigot wedge ring relative to said wedge housing, said axial movement imparting sliding axio-radial movement of said frusto-conical surfaces relative to one another.

49. The restraint of claim 45 wherein said spigot gripping protrusions are biased to prevent axial compression of the pipes.

50. The restraint of claim 49 wherein said frusto-conical surfaces are biased to prevent axial compression of the pipes.

51. The restraint of claim 50 further comprising an actuator driving said spigot gripping protrusions into said spigot pipe by imparting axial movement of said spigot wedge ring relative to said wedge housing, said axial movement imparting sliding axio-radial movement of said frusto-conical surfaces relative to one another.

52. The restraint of claim 45 wherein the frusto-conical surfaces are biased to prevent axial separation of the pipes.

53. The restraint of claim 52 further comprising an actuator driving said spigot gripping protrusions into said spigot pipe by imparting axial movement of said spigot wedge ring relative to said wedge housing, said axial movement imparting sliding axio-radial movement of said frusto-conical surfaces relative to one another.

54. The restraint of claim 45 wherein the frusto-conical surfaces are biased to prevent axial compression of the pipes.

55. The restraint of claim 54 further comprising an actuator driving said spigot gripping protrusions into said spigot pipe by imparting axial movement of said spigot wedge ring relative to said wedge housing, said axial movement imparting sliding axio-radial movement of said frusto-conical surfaces relative to one another.

56. The restraint of claim 42 wherein said socket wedge ring further comprises a frusto-conical surface in effective contact with an opposed frusto-conical surface in said wedge housing.

57. The restraint of claim 56 wherein said socket gripping protrusions are biased to prevent axial separation of the pipes.

58. The restraint of claim 57 wherein said frusto-conical surfaces are biased to prevent axial separation of the pipes.

59. The restraint of claim 58 further comprising an actuator driving said socket gripping protrusions into said socket pipe by imparting axial movement of said socket wedge ring relative to said wedge housing, said axial movement imparting sliding axio-radial movement of said frusto-conical surfaces relative to one another.

60. The restraint of claim 56 wherein said socket gripping protrusions are biased to prevent axial compression of the pipes.

61. The restraint of claim 60 wherein said frusto-conical surfaces are biased to prevent axial compression of the pipes.

62. The restraint of claim 61 further comprising an actuator driving said socket gripping protrusions into said socket pipe by imparting axial movement of said socket wedge ring relative to said wedge housing, said axial movement imparting sliding axio-radial movement of said frusto-conical surfaces relative to one another.

63. The restraint of claim 56 wherein the frusto-conical surfaces are biased to prevent axial separation of the pipes.

64. The restraint of claim 63 further comprising an actuator driving said socket gripping protrusions into said socket pipe by imparting axial movement of said socket wedge ring relative to said wedge housing, said axial movement imparting sliding axio-radial movement of said frusto-conical surfaces relative to one another.

65. The restraint of claim 56 wherein the frusto-conical surfaces are biased to prevent axial compression of the pipes.

66. The restraint of claim 65 further comprising an actuator driving said socket gripping protrusions into said socket pipe by imparting axial movement of said socket wedge ring relative to said wedge housing, said axial movement imparting sliding axio-radial movement of said frusto-conical surfaces relative to one another.

67. A concentric pipe joint restraint, said restraint resisting axial movement of a spigot pipe relative to a socket pipe within which a portion of said spigot pipe has been inserted, said spigot pipe and said socket pipe defining an annulus, said restraint comprising:

a spigot wedge ring comprising one or more spigot gripping protrusions which grip said spigot pipe and a first radial surface;

a socket wedge ring comprising one or more socket gripping protrusions which grip said socket pipe and a second radial surface in effective contact with said first radial surface so as to prevent axial movement of the spigot pipe relative to the socket pipe.

68. The restraint of claim 67 wherein the wedge rings and radial surfaces are biased to prevent axial separation of the pipes.

69. The restraint of claim 67 wherein the wedge rings and radial surfaces are biased to prevent axial compression of the pipes.